Understanding the Role of Technology Interventions in the Classroom

MCCPTA Subcommittee on Safe Technology

In 2017, Montgomery County Public Schools (MCPS) commissioned The Johns Hopkins Institute of Education Policy (Johns Hopkins) to conduct a review of its Curriculum 2.0. John Hopkins issued its findings in March 2018. The central recommendation was that MCPS adopt *an externally-developed curriculum including software platforms* for the delivery of English Language Arts and Math content.[1] In April, MCPS quickly opened a Request for Proposal (RFP) to solicit a new curriculum, but this process was temporarily suspended due to conflict-of-interest concerns. It is expected that the RFP process will resume once key positions vacated by recused individuals are filled.

An Opening for Renewed Evaluation and Advocacy

This period of review offers teachers, parents, and other supporters of effective public education in Montgomery County much-needed time to examine the premises and the conclusions of the Johns Hopkins report. According to the publicly-released Executive Summary, the only community input received by the study group is described as "survey data of the views of stakeholders." The nature and details of what information this survey data included is not shared. In contrast, the report notes that, "the research team conducted 52 focus groups and interviews at 20 MCPS elementary and middle schools with 324 educators – including both teachers and central staff – collecting 2,441 comments." The seeming exclusion of systematic community input from parents and, notably, teachers in a setting outside the school where they may be able to respond more freely exposes the study to deficiences stemming from inadequate stakeholder voices.

In particular, mitigated community input may have contributed to the lack of evaluation in the study of an important ingredient in the making of an effective classroom: the role of technology.

MCCPTA's Safe Technology Subcommittee has long advocated for rigorous evaluation of technology interventions in the classroom. In 2018, the members of the subcommittee joined other interested Maryland residents to support HB1110 in the Maryland General Assembly, which asks the Maryland State Department of Education (MSDE) to investigate the effectiveness and safety of technology interventions in classrooms across the state. HB1110 became law in April 2018.[2]

In light of the work that MSDE is expected to do in pursuit of the new law and the opportunity for evaluation offered by the prospect of MCPS buying a new curriculum, we as a committee would like to start a conversation within MCCPTA, the County's primary parent-teacher body, and to engage MCPS on the question of the effectiveness and safety of a new curriculum is computer- and screen-based.

We hope to join MCCPTA's Curriculum Committee to evaluate current research on the subject and to determine an advocacy position for MCCPTA as an organization. Toward that end, we would like to bring from Committee to the MCCPTA Board and to the Delegate's Assembly discussion, evaluation and a Resolution on how technology is best utilized in the classroom, and how its effectiveness will be measured going forward.

Does Technology Improve Learning Outcomes?

The central question here is how technology interventions in classrooms improve learning outcomes. The promise of technology is widely held. As Thomas Friedman famously argued more than a decade ago, access to technology was making the World Flat, which implied that technology removed social and economic barriers to economic and social mobility. Teachers, schools, and society in general have largely accepted this promise. Legislators in California and Florida, two of the largest states in the U.S., have passed laws requiring digital textbooks.[3] Technology access has been pushed as an instrument of education equity.[4]

In the face of this technological optimism, actual empirical research on the impact of technology on learning in the classroom is actually sparse and sobering. Part of the problem appears to be the multicausal nature of the learning process, which makes it hard to disentangle the impact of technology from the quality of the curriculum and teachers, and the effects of a difficult home environment. The largest study to look at the problem is a multinational OECD (Organisation for Economic Cooperation and Development) report published in 2015. The OECD report correlates computer availability and use in classrooms a number of countries with performance on standardized testing to arrive at this stark observation:

> "In 2012, 96% of 15-year-old students in OECD countries reported that they have a computer at home, but only 72% reported that they use a desktop, laptop or tablet computer at school. Only 42% of students in Korea and 38% of students in Shanghai-China reported that they use computers at school – and Korea and Shanghai-China were among the top performers in the digital reading and computer-based mathematics tests in the OECD Programme for International Student Assessment (PISA) in 2012. By contrast, in countries where it is more common for students to use the Internet at school for schoolwork, students' performance in reading declined between 2000 and 2012, on average."[5]

In a study of undergraduate students, Rutgers University psychologist Andrew L. Glass and Mengxue Kang found that students using electronic devices in the classroom performed half a grade below students who did not use electronic devices in tests.[6] Indeed, students in classrooms that allow electronic devices do worse than students in classrooms where electronic devices are not permitted, implying that electronic devices in classrooms have peer effects on students who are not using electronic devices as well. Glass and Kang find that use of electronic devices did not reduce contemporary comprehension of the lecture, but rather affected tests taken at a later date. They conclude that the impact of electronic devices in classrooms adversely impacts long-term retention rather than immediate recall of the material.

In a 2017 review essay, University of Maryland researchers Patricia A. Alexander and Lauren M. Singer examine exisiting research since 1992 on the narrower question of reading comprehension differences between print and digital texts. They found that when reading texts longer than one page, the research showed better comprehension outcomes with print rather than with digital texts.[7] The research atrributes this to the disruptive effect of scrolling on screens. Their own research shows a paradox in the students self-reporting better comprehension with and clear preference for digital texts but performed better in actual tests of comprehension when using printed matter.[8]

The paradox between the technological optimism of advocates and the reality of contradictory and undiscernible results provided by empirical studies of technological interventions in education goes beyond students alone. A 2014 survey of 400 educators and administrators and 1,000 middle and high-school students sponsored by CompTIA, an IT trade association, found "75 percent of educators think that technology has a positive impact in the education process."[9]

This finding stands in contrast to the studies such as the 2015 OECD report that do not support a positive correlation between technological intervention and learning outcomes. It is worth noting that 2015 OECD report, showed modest gains from technology interventions in some classrooms (with low to moderate use).

The prevalence and persistence of this paradox is puzzling. Potentially, two factors are at play. First, we believe there is significant industry pressure on the purchase and possibly continued maintenance of the curriculum contract. In this context, it is worth noting that Discovery Education, which has been at the center of the conflict of interest concerns around the MCPS RFP, offers almost all-screen-based curriculum. Second, years of professional development extolling the importance of "innovation" in learning has predisposed teachers to viewing input as output, access as equity, and many teachers appear to be in a race to be cutting edge, often ignoring MCPS Technology Office's prohibitions on certain apps and programs.

While California and Florida are pressing forth on digital learning, the State of Maine, the first state to adopt a one-to-one laptop program, has discontinued the program after a decade of data showing no impact on learning outcomes.[10] Recent newspaper articles report that early leaders in the technology industry now insist on a no- or low-tech learning environment for their own children.[11] In higher education, professors are increasingly banning laptops from the classroom.[12]

Does Technology Reduce the Achievement Gap?

On equity, school-based technology was one hope for leveling the playing field for minorities and poor families. The actions of the California and Florida state legislatures reflect in part an intent to bring down the cost and improve access to curriculum. Technology firms have backed initiatives like the Khan Academy to deliver material where teachers are either unavailable or unable. In developing countries, access to education through handheld devices is believed to enable leapfrogging over absent infrastructure such as school buildings.

However, empirical evidence of success is hard to find. Arguments in favor of increased technology interventions for equity reasons, typically, mistake input for outcome or add variables so that the impact of technology becomes impossible to discern. Moreover, as the paradox of expectations of learning among students and teachers show, there can be significant differences between self-reported survey results and actual performance.

A widely-cited 2014 Stanford study, for example, identified relatively lesser access to computers among poorer and minority students as the crux of the learning problem, thereby making access to computers the preferred solution.[13] One of the few empirical examples of success in the study comes from Talladega County, Alabama, which is described as "a district where 73 percent of students qualify for free or reduced-price lunch, dropout rates were high, and college-going was low" which, "over the course of just two years…led to an increase in graduation rates from 63 percent to 87 percent and a climb in college acceptance rates from 33 percent to 78 percent. During the same period, the high school had significant decreases in suspensions, alternative school referrals, and dropout rates, preventing failures that had previously routinely occurred."[14]

On closer examination, rather than evaluating the impact of technology on learning, the report finds that increased teacher interaction is necessary to make technology interventions work. This raises the obvious question whether increased teacher interaction *without* the technology intervention might have had similar results. The study speaks to technology interventions without changes in teacher engagement here:

> "Results from these efforts have been largely disappointing. In some cases, students demonstrated improved outcomes on tests of similar information tested in a similar format; in most, they performed about the same as students taught by teachers during the same time period. One recent study, for example, used rigorous methods of random assignment to evaluate the impact of a variety of math and reading software products across 132 schools in 33 school districts, with a sample of more than 9,400 students, and found no significant difference on student test scores in classrooms using the software as compared to classrooms not using the software. Another large study using random assignment methods to evaluate the effectiveness of students' exposure to a phonics-based computer program also found no effect in terms of gains on reading comprehension tests."[15]

If anything, the conclusions suggest that technology without adequate one-on-one teaching can be counterproductive. The OECD's director of the Office of Education Research, Andreas Schleicher, stated that, "One of the most disappointing findings of the [2015] report is that the socioeconomic divide between students is not narrowed by technology, perhaps even amplified."[16]

What are the Dangers of Increased Screen and Computer Time?

There is little doubt that the introduction of smartboards and Google Chromebooks in school have marked a dramatic shift in content delivery in classrooms. In 2012, Florida state legislature reflected this shift when it passed a law requiring 50 percent of all classroom instruction to be digital by 2015.[17] A 2016 Children and Screen Time advisory report from the Office of Education for Santa Clara County, CA, similarly highlights the importance of technology in enhancing learning opportunities.[18]

Neither Florida nor Santa Clara County are known to have conducted audits of their claims about the impact of technology, but a 2016 study reported in the *Journal of Pediatric Health* reported strong correlation between screen time and sleep health.[19] Research on screen time is problematic because the making of control and experimental groups of human child subjects would violate most research board reviews.[20] Still, the medical research community has decided that there is sufficient cause to take notice.

The American Academy of Pediatrics recommends that "parents and caregivers develop a family media plan that takes into account the health, education and entertainment needs of each child as well as the whole family…proactively think about their children's media use and talk with children about it, because too much media use can mean that children don't have enough time during the day to play, study, talk, or sleep."[21] Furthermore, Common Sense Media, an organization devoted to balance in screen time, reports that 59 percent of parents say their kids are "addicted" to their screens, while 66 percent say their kids spend too much time on screens.[22]

The use of medical authority in this debate presents contradictions. The Santa Clara screen time advisory references an American Academy of Ophthalmology report stating, "there is no convincing scientific evidence that computer video display terminals (VDTs) are harmful to the eyes," but the reference to the assertion links to the Health Physics Society Journal, which thereafter does not identify a source from the American Academy of Ophthalmology. Meanwhile, the American Academy of Ophthalmology website displays the organization's recommendation to limit screen time to prevent eye strain and damage. In short, the Santa Clara advisory from 2016 does not factor in the American Academy of Opthalmology's warnings, but the organization is cited as a source.

Finally, student screen and internet usage has raised questions about privacy. A number of states and school districts are cracking down on child privacy laws. Baltimore County Public Schools has taken extra steps to ensure privacy of student data[23] and the state of Texas is considered a pioneer of child privacy laws and efforts with the passage of HB2087, which provides strong privacy protections for student data within Texas public schools.[24] MCPS itself has been trying to lock-down servers and examine its custodial responsibilities with respect to student data, but this remains an early work in progress. Anecdotally, parent reports to the MCCPTA Safe Technology Subcommittee suggest a race among teachers to introduce more technology, some of which may violate the Children's Online Privacy and Protection Act (COPPA) and go unvetted by the MCPS Technology Office. This leaves the MCPS CTO and team to play catch-up with actual practice inside schools.

Where is the Balance?

The objective here is not to seek removal of all technology from classrooms, but to try to find the right balance. However, the persistent disconnect between deductive expectations of technology and self-reporting survey results, on the one hand, and available empirical evidence of actual student performance, on the other, presents a real policy challenge for school systems such as MCPS.

HB 1110 instructed the Maryland State Department of Education to evaluate the effectiveness and safety of technology interventions in classrooms across the state. At the county level, we can contribute to this effort with meta-analysis of student login time data. A simple correlation of login duration and test scores, for example, should reveal preliminary relationships between computer time and test performance. True causal arguments would require more sophisticated work, but we can begin to address the issue of actual learning outcomes.

The Johns Hopkins study seemingly did not address the issue of digital learning effectiveness. Based on the study and other official MCPS reporting of the study, we do not know how much time Montgomery County school students spend on the computer at school or at home. Further, we do not understand what the impact of technology interventions has been on learning outcomes in MCPS classrooms. Specifically, what ages or what subject matter benefit most from screen-based learning and where screens can be detrimental. The study does not provide evidence of learning measures to determine where we stand on these questions. Nevertheless, it recommends externally-developed digital platforms for delivery of the new curriculum despite current research calling into question the effectiveness of curriculum significantly delivered via screens.

The reconsideration of the RFP process allows the MCPS community to take into account this current research and to craft an evidenced-based approach to digital learning.

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